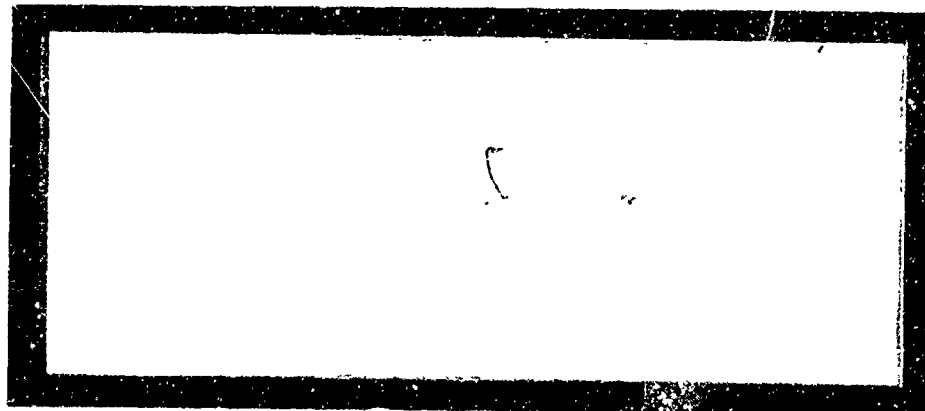


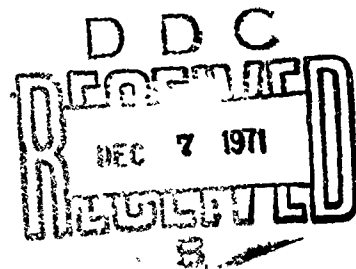
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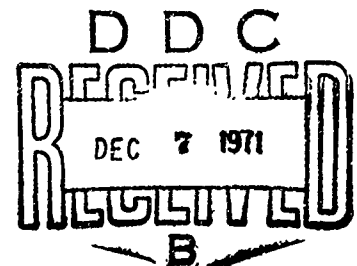
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THE LIFE HISTORY QUESTIONNAIRE:  
PREDICTION OF PERFORMANCE IN NAVY DIVER TRAINING

Robert Helmreich and Roger Bakeman  
The University of Texas at Austin  
Roland Radloff  
National Science Foundation

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Abstract

A new demographic instrument, the Life History Questionnaire (LHQ) is described. The LHQ elicits demographic data longitudinally providing a question by year matrix of responses. Variables derived from the LHQ are used to predict success in Navy diver training. The utility of the LHQ both for prediction and as a research tool is discussed.

The Life History Questionnaire:  
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One of the most widely accepted truisms in psychology is that the best predictor of future behavior is past behavior. Research evidence supports this contention; for example, the best predictor of college grades is high school grades; previous income predicts success in selling life insurance (Tanofsky, Sheff & O'Neill, 1969); completion of high school predicts completion of service school and Navy enlistment (Plag & Goffman, 1966); it is assumed that the best jet pilots will make the best Astronauts (Voas, 1961). Our own previous research has also convinced us of the value of such information. In a study of Aquanaut performance during the Navy's Project SEALAB II, life history items were very successful in predicting performance, especially in contrast with personality and interest inventory data (Radloff and Helmreich, 1968).

Theoreticians have argued the potential power of life history information (see Guthrie, 1944, for an especially compelling argument). More recently it has been asserted that biographical information is the "best single predictor of future behavior where the predicted behavior is of a total or complex nature " (Henry, 1966).

Despite the widely assumed and partially demonstrated utility of life history information, little effort appears to have been devoted to understanding the conceptual properties underlying such information. It appears that biographic data have been used because they work. They have been used mainly in practical, applied situations such as counseling and personnel selection and on a strictly empirical level. The truism regarding past behavior may appear so self-evident that it precludes the question "Why does it predict?" In any case, users seem to have had little inclination to develop conceptual and theoretical understanding of the information (Baehr & Williams, 1967). The norm seems to be that each investigator has used a few life history questions either because they had been used previously or because there was some "common sense" notion that they would have relevance to his study. Whether in field or laboratory studies, applied or basic research, only a few variables have been used in most studies. This has resulted in the investigation of a large number of variables and conceptual understanding of almost none. Examples of standard items are: age, education, parents' education, occupation, income, socioeconomic status, hometown size, educational performance, religious activity and birth order.

Investigations of birth order effects illustrate one of the common deficiencies in the use of life history information. Since the publication of Schachter's Psychology of Affiliation (1959), hundreds of investigators have examined birth order in the laboratory and in the field, in relation to a variety of criteria. However, despite this massive research activity, there is little understanding of the psychological properties of the variable. We agree with Sampson (1965) that a large part of the difficulty is that birth

order has been studied in isolation from other relevant information. In order to identify accurately its effects and to understand them, it is necessary to study birth order in relation to a number of other variables. A few of the more relevant ones would seem to be sex, family size and composition, and socioeconomic status. A similar situation exists with regard to almost any life history item. Most have been studied in isolation; they need to be examined in a comprehensive context.

The impetus for the development of the Life History Questionnaire was a large-scale field investigation of the behavior of Aquanauts during Project TEKITE 2 (Helmreich, 1971). Our goal was to understand and explain differences among TEKITE Aquanauts in their ability to work effectively underwater, to get along with fellow teammates, and to adjust generally to a stressful, isolated and confining environment. Since we were attempting to predict complex real-life behavior, it followed that the best predictive information would be a total record of prior experiences. We looked for and failed to find extant measuring instruments which would yield such information.

The Life History Questionnaire. The Life History Questionnaire (LHQ) was conceived and designed to assess experience and behavior during the first 19 years of a person's life. Its intent is to elicit comprehensive information by covering such areas as place of residence; size of hometown; frequency of moves; type and size of residence; size and composition of family; quality of food and clothing; father's and mother's employment, education and occupation; comparative height and weight; health; type and size of school; school performance; participation in athletic and other activities; religious participation; frequency of going out at night and dating; fights with peers; clashes with



authority; parental praise, criticism, physical affection, and punishment, work and financial independence. These are shown in Table 1.

Two major influences guiding the selection of areas to be covered were: A Catalogue of Life History Items (Owens, Glennon & Albright, 1966) and a factor analytic study of the dimensions of personal background data (Baehr & Williams, 1967). Examination of extant instruments indicates an apparent confusion in the field over what constitutes a fact of life history. For example, a majority of the questions appearing in the Catalogue of Life History Items do not ask for factual information. Instead, they deal with attitudes, feelings and opinions. For example, "How do you feel about your share of happiness in life?" "What type of person do you like?" Opinions, attitudes and feelings deserve to be studied in their own right, as indeed they have been. However, they should not be confused with facts about past experience.

Questions in the LHQ emphasize the occurrence of events rather than attitudes and feelings. For example, "In what size community did you live?" rather than, "In what size city would you prefer to live?", or "How often did your parents punish you?" rather than "How strict did you feel your parents were?"

Qualitative responses can also dilute factual information. Qualitative responses result when response categories such as "never, seldom, frequently, often or very often" are used. The problem is, of course, that one man's "frequently" is another's "seldom". Even if the person recalls the information accurately, he may still not answer accurately because of semantic confusion. In the LHQ, wherever possible, responses are coded in numerical frequencies such as: once per year, once per month, once per week, daily, etc. Accuracy of

recall and reporting, remain as potential sources of error, but semantic confusion is minimized by using quantitative categories.

An essential feature of the LHQ is the provision for year-by-year responses. Twelve questions are answered 19 times, once for each year. The other 20 questions ask for responses only for appropriate years, as in questions on dating, school attendance, and school performance. The use of multiple responses permits measurement of several important aspects of life history, including: number of changes, direction of changes, rate of development and age at occurrence of an event. A few examples may illustrate the importance of such information. Later behavior may be influenced as much by number of moves or hometown sizes as it is by hometown size; as much by improvements or declines in school performance as it is by average performance; as much by rate at which financial independence is achieved as it is by the fact of its achievement; and as much by the age at which parents were divorced or died as it is by the fact of divorce or death. Influences deriving from such factors as the number and direction of changes, rate of development, and age at occurrence of events cannot be known unless a matrix of data is available. Questions answered year-by-year seem to be the most sensitive method of obtaining this information.

The nature of questions on the LHQ may be illustrated by the question concerning health. The instructions for the question begin, "How healthy or unhealthy have you been? For each year of age, indicate the number of days you have been unable to take part in regular activities because of ill health by use of the appropriate number from the categories defined below. Unable to take part in regular activities means being in a hospital; staying home from

school or work; staying home on weekends, holidays or evenings when you might normally have been out of doors, visiting friends, going somewhere for entertainment or recreation, doing errands or similar activities." This is followed by additional information concerning response categories. The response categories used are:

1. 0 days of restricted activity due to ill health
2. 1 to 6 days restricted activity due to ill health
3. 7 to 14 days, 1 to 2 weeks, restricted activities due to ill health
4. 15 to 30 days, more than two weeks, up to 1 month restricted activities due to ill health
5. 31 to 60 days, 1 to 2 months, restricted activities due to ill health
6. 61 to 120 days, more than 2 and up to 4 months, restricted activities due to ill health
7. 121 to 140 days, more than 4 and up to 8 months, restricted activities due to ill health
8. 241 or more days, more than 8 months and up to the full year, restricted activities due to ill health
9. Don't remember

The first applications of LHQ derived predictors to behavioral criteria were highly successful and have been reported elsewhere for Aquanauts (Helmreich, 1971) and Navy divers (Radloff, 1971). In the present paper, we will present an application of the data available from the LHQ to prediction of completion and relative standing in two demanding military schools training Navy divers, 2nd Class.

#### Method

Subjects were 115 male enlisted men in the U. S. Navy who composed five

classes in training to be Divers 2nd Class.<sup>2</sup> This school population is composed of volunteers and presents basic instruction in SCUBA diving for the Navy. All subjects were given the LHQ at the beginning of the training course. At the end of the 10 week course, criterion information was collected for each trainee. The criteria were completion or non-completion of the course and class rank for those successfully completing training.

Scoring and Coding LHQ Data. The LHQ is answered on a machine readable answer form from which responses are automatically transcribed onto punch cards producing a matrix of yearly responses. In addition to the response matrix, several background questions such as father's education, Ss current weight, etc., are answered only once. These data are then processed by program LIHAN (Life History Analyzer; Bakeman, 1971). This program permits the investigator to extract from combinations of raw data of the LHQ values of a priori variables for each subject.

To do this, conceptual variables must first be defined. This is done by constructing a table where each entry or line in the table describes a different conceptual variable. For each conceptual variable, the user indicates: (1) the statistic to be computed; these include mean, median, mode, change scores, and trend scores; (2) the LHQ questions to be used; and (3) within that question, the years to be considered in the analysis.

Given the data available from the LHQ, an almost limitless number of conceptual variables could be formed; in practice, only a few would be. Research hypotheses and previous experience will typically suggest appropriate variables. Here, we have allowed our prior experience with divers to guide conceptual variable definition. Since the present study is intended primarily as an exploration of the use of the LHQ, we have deliberately defined only a limited number of variables.

## Results

The first two classes studied were assigned to the validation sample (N=52). The next three classes (N=63) were assigned to the cross-validation sample. 61% (32) of the validation sample completed training successfully. 57% (36) of the cross-validation population completed the course.

Two criteria were formed for the samples. The first, a pass-fail indicator, was coded with 0=Fail, 1=Pass. A broader, four-point performance criterion was formed with 1=non-completion, 2=completion in the bottom 1/3 of the class, 3=completion in the middle 1/3 and 4=completion in the top 1/3.

Four predictors were computed as the mean of yearly responses between the ages of 13 and 17 inclusive. These were: (1) Parental Affection (mean number of occasions when parents expressed physical affection); (2) Educational Performance (relative secondary school class rank); (3) Health (coded as mean number of days restricted due to illness or accident); and (4) Athletic Honors (mean number of recognitions for athletic endeavor).

Two variables designed to reflect socioeconomic status were formed from LHQ items. The first (called Social Status) was the sum of father's educational level, mean quality of food served in the home, and mean quality of clothing provided for subject). The second variable (called Home-Family Index) was computed by subtracting the mean number of persons living in the nuclear family from the mean number of rooms in the family domicile.

Four additional variables were based on single response items on the LHQ. These were: subject weight; the weight-height ratio (weight divided by height in inches); difference in parental education (father's educational level minus mother's educational level); and birth order (first-born vs. later born).

The correlations of predictors with the criteria for the validation sample are shown in Table 2. The multiple regression analyses were conducted using the SPSS regression program (Nie, Bent and Hull, 1970) with a .01 confidence level of beta weights for inclusion in regression equations. For the Pass-Fail criterion, all 10 predictors met the inclusion requirement and yielded a multiple correlation of .60. The cross-validity of the predictive equation was .58 with a standard error of estimate of .44. The means and standard deviations of predictors for both samples and beta weights for the validation sample are shown in Table 3.

The multiple correlation with the performance criterion was .61 in the validation sample. The multiple correlation in the cross-validation sample was .59 with a standard error of estimate of 1.25. Beta weights of predictors for the performance criterion are shown in Table 4.

### Discussion

Correlations with the criteria provide some indication of characteristics associated with success in a rigorous diving course. The high positive correlation between receiving physical affection and success in military training is interesting not only because it demonstrates a strong relationship between family atmosphere and the criteria but also because it seems to support the contention that the objective format of the LHQ can provide quantitative information about rather subjective experiences. The correlations between educational performance and the criteria are in the expected direction, higher class rank is associated with course completion and performance. IQ scores (in the form of scores on the Navy's General Classification Test) were available for some subjects (N=38). The correlation between the IQ measure

and the Pass-Fail criterion was non-significantly negative ( $-.11$ ). This implies that the LHQ question concerning school performance is more related to achievement motivation than to academic intelligence.

The relationship between Health and the criteria, although non-significant, is in a counter-intuitive direction and replicates a finding obtained with Scientist-Aquanuts during Project TEKTITE 2 (Helmreich, 1971). This is a tendency for successful performers to have experienced considerable restriction because of illness or accident. Another aspect of this relationship between health and performance illustrates one of the major capabilities of the LHQ. In a detailed analysis of the relationship between the health variable at different age periods and performance among TEKTITE Aquanuts, it was found that the effect was caused by a strong relationship between illness during elementary school years (6-12) and the criterion. Among Aquanuts, the relationship was much weaker both in early childhood and during teenage years. In examination of the data for the Navy sample, the same effect is noted. The correlation between the health variable and the Pass-Fail criterion for years 6-12 was  $.32$  while the correlation for ages 0-5 years was  $.16$ . One implication is that restriction during early school years with subsequent recovery may lead to an emphasis on physical achievement. In any event, the LHQ data facilitate the exploration of such questions concerning the relative importance of experiences at different ages.

Birth order was significantly related to the Pass-Fail criterion with primogeniture associated with success (also replicating the effect found among Aquanuts; Helmreich, 1971). The LHQ provides extensive data on ordinal position and sibling structure. However, because of the limited sample size, only a dichotomous predictor was formed.

The Athletic Honors variable correlates positively with the criterion. This quantitative measure of athletic accomplishment relates strongly to the physical task of diving. The two variables relating physique to completion and performance show moderate relationships in the not-surprising direction that heavier and stockier (higher weight-height ratio) divers are somewhat more likely to pass. The relationship to the performance criterion is much weaker, probably indicating a threshold effect. That is, a stocky diver is likely to pass, but beyond that, the extent of his stockiness does not predict how well he will do.

The two socioeconomic predictors were also more strongly related to the Pass-Fail criterion than to the performance measure. Higher socioeconomic status is associated positively with the Pass-Fail criterion, but only weakly with the performance measure. This distinction between variables that predict attainment of an acceptable level of performance and those that predict variations in levels of excellence seems both a practical and a theoretically fascinating one. Clearly, it calls for further investigation.

The ability of variables derived from the matrix of information available from the Life History Questionnaire to predict performance in diver training suggests that the LHQ may be a highly useful tool. Studies are currently underway relating the LHQ to performance in other settings. However, the most important feature of the instrument appears to be the fact that it provides sufficient longitudinal data to enable detailed investigation of the relationships among a variety of life settings and experiences and to relate these to subsequent behavior. With a large data base, many developmental and social hypotheses can be systematically explored.



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## Footnotes

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2. The 1st and 3rd classes were from the U. S. Navy School of Diving and Salvage, Washington, D. C.; the 2nd and 4th and 5th were from the U. S. Navy Diving School, Harbor Clearance Unit 2, Norfolk, Virginia.

Table 1

## Life History Questionnaire Items

<u>Multiple Response Items</u>	<u>Age Range (by year)</u>
1. Geographical residence.	0-18
2. Hometown size.	0-18
3. Distance of home from larger population centers.	0-18
4. Type of residence.	0-18
5. Condition and status of residence.	0-18
6. Family size and composition.	0-18
7. Clothing quality.	0-18
8. Food--quantity and quality.	0-18
9. Father's employment.	0-18
10. Mother's employment.	0-18
11. Height.	0-18
12. Weight.	0-18
13. Health.	0-18
14. Education--type of school.	5-18
15. Education--size of school.	5-18
16. Education--academic performance.	5-18
17. Athletic achievement and awards.	5-18
18. Intellectual achievement and awards.	5-18
19. Other awards and honors.	5-18
20. Religious activities.	5-18
21. Going out at night.	5-18
22. Dating.	12-18
23. Fights with peers.	5-18
24. Clashes with authority.	5-18
25. Financial independence.	5-18
26. Work--school year.	5-18
27. Work--summer months.	5-18
28. Parental praise.	5-18
29. Parental physical affection.	5-18
30. Parental verbal criticism.	5-18
31. Parental physical punishment.	5-18
32. Community homogeneity and personal similarity.	0-18
<u>Single Response Items</u>	
1. Father's occupation	
2. Mother's occupation	
3. Father's education	
4. Mother's education	
5. Subject's education	
6. Other languages spoken	
7. Height	
8. Weight	
9. Birth month and year	
10. Marital status	
11. Sex	

Table 2

Product-moment Correlations of Predictors with Criteria Validation Sample (N=52)

	1	2	3	4	5	6	7	8	9	10	11	12
1. Parental Affection <sup>a</sup>	1.000											
2. Educational Performance <sup>a</sup>	-.274	1.000										
3. Health <sup>a</sup>	.005	.168	1.000									
4. Athletic Honors <sup>a</sup>	.242	-.314	.021	1.000								
5. Weight	.096	.004	.054	.218	1.000							
6. Wt/Ht	.075	.045	.023	.202	.956	1.000						
7. Difference in Parents Ed.	-.365	.229	-.030	-.152	-.118	-.050	1.000					
8. Birth Order	-.218	.001	.097	-.048	.139	.114	-.027	1.000				
9. Social Status Index	.130	-.330	-.171	.092	.021	.046	.025	-.079	1.000			
10. Home Family Index	.006	.018	.023	.028	.099	.116	.103	-.158	.278	1.000		
11. Pass-Fail Criterion	.402	-.202	.200	.368	.177	.207	-.160	-.258	.160	.253	1.000	
12. Performance Criterion	.376	-.208	.201	.441	-.075	-.103	-.120	-.160	.032	.108	.841	1.000

<sup>a</sup> Based on mean of responses for ages 13-17 inclusive

Table 3

Statistics of Variables Comprising Regression Equation for Pass-Fail Criterion

Variable	Mean (Validation Sample)	Mean (Cross-Validation Sample)	Standard Deviation (Validation Sample)	Standard Deviation (Cross-Validation Sample)	Beta Weight (Validation Sample)
1. Parental Affection	4.01	4.81	2.20	1.91	.254
2. Athletic Honors	2.25	2.41	1.68	1.76	.239
3. Health	1.73	1.82	.60	.85	.223
4. Birth Order	.62	.61	.89	.87	-.222
5. Social Status Index	17.16	16.51	2.56	2.43	.111
6. Weight	170.98	173.05	20.20	20.22	.525
7. Wt/Ht Ratio	2.42	2.44	.25	.26	-.428
8. Educational Performance	4.96	4.54	.72	1.36	-.045
9. Home-Family Index	-.76	-.49	1.60	1.80	.031
10. Educational Difference	1.65	1.63	.48	.49	.014
Regression Constant					-.274

Table 4  
Beta Weights of Variables Comprising  
Regression Equation for Performance Criterion

Variable	Beta Weight (Validation Sample)
1. Athletic	-.363
2. Parental Affection	-.278
3. Health	-.184
4. Birth Order	.094
5. Weight/Height Ratio	.718
6. Weight	-.660
7. Home-Family Index	-.100
8. Educational Difference	-.084
9. Educational Performance	.053
10. Social Status Index	.041